



Fact Sheet

ODS & SGG Alternatives for the Fire Protection Industry 2018

The Australian Government is committed to reducing emissions of ozone depleting substances (ODS) and synthetic greenhouse gases (SGG) listed under the Montreal Protocol and the United Nations Framework Convention on Climate Change. In the fire protection industry, ODS & SGG emissions occur mainly because of leakage or release from industrial and commercial gaseous fire systems.

The Fire Protection Industry (ODS & SGG) Board (the Board) administers the extinguishing agent permit scheme under the Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995 on behalf of the Australian Government. Under the scheme individuals who handle or work with fire protection equipment, where activities may cause an emission of ODS and SGG extinguishing agents, must hold an extinguishing agent handling licence (EAHL).

The Board's strategic plan identifies as key goals, a reduction in emissions of, and the transition away from, ODS & SGG gases used in fire systems. The fire protection industry and its suppliers have developed several solutions that do not rely on ozone-depleting or global warming gases and which are readily available for a variety of applications. The Board has developed this fact sheet to help industry and end users consider more environmentally acceptable options when designing a new or upgrading an existing system.

Contents

2 Why should you consider alternatives?

When can you change to alternatives?

Maintaining fire suppression systems

3 Inert gases

4 FK-5-1-12

5 CO₂ fixed fire suppression

6 Water sprinkler systems

7 Water mist systems

8 Hybrid (water mist/inert gas)

9 Condensed aerosol

10 Oxygen reduction fire prevention (ORFP) systems

11 Appendix

Why should you consider alternatives?

Hydrofluorocarbons (HFCs) such as FM-200, hydrochlorofluorocarbons (HCFCs) such as NAF-S-III and halon have been used in fire suppression systems for many years, but are ozone-depleting substances and/or contribute to climate change. Further information on the common types of HFCs, HCFCs and halons used in fire suppression systems is available on the Board website www.fpiib.com.au. ODS damage the earth's protective ozone layer, allowing more harmful ultraviolet radiation from the sun to reach the earth. SGGs trap heat in the atmosphere and contribute to climate change which will result in significant environmental and economic effects such as rising sea levels and more frequent adverse weather events such as cyclones and storms.

Minimising and ultimately eliminating the use of ODS and SGG in fire protection has not only environmental benefits but also operational ones. Technicians who do not handle ODS and SGG substances are not required to hold an EAHL.

When can you change to alternatives?

There are several opportunities in the life of a fire suppression system to change from existing ODS and SGG gases to a more environmentally friendly alternative, such as:

- 1) Australian Standard AS 1851 Maintenance of fire protection equipment and systems specifies ten yearly hydro testing of gaseous fire system cylinders. This can be an expensive exercise, especially where large numbers of cylinders are installed. As such, it may be cost-effective to change the system to use an alternative fire-extinguishing agent.
- 2) In the event of a discharge, it may be prudent to investigate using an alternative system rather than incur the cost of refilling the original system.
- 3) When there is a change in the fire risk of the protected areas, such as a system extension or change in use.
- 4) A facility upgrade or change.

Scheduled events such as hydro testing or facility upgrade are easier to plan for and allow time to engage with the system owner to get the most effective outcome.

However, planning can also be undertaken when there is a discharge. The maintenance provider can engage with the system owner to establish a plan in advance should a discharge occur. Please refer to the Appendix for considerations when changing to an alternative.

Maintaining fire suppression systems

All fire suppression systems should be maintained to AS 1851-2012, Routine service of fire protection systems and equipment, and in accordance with manufacturer's recommendations. to ensure correct operation when required. In the case of hybrid water mist and ORFP systems, which are not specifically covered by this standard, systems should be maintained in accordance with the manufacturer's recommendations.

Alternative fire suppression gases

The following alternatives are considered to have nil or very little ozone-depleting potential and will not contribute to global warming. It is important that you do not rely on the information contained in this fact sheet alone. Further information must be obtained from manufacturer's specifications, and fire design professional.

For more Information

Contact the Fire Protection Industry (ODS & SGG) Board:

call 03 8892 3131

email ozone@fpiib.com.au

visit www.fpiib.com.au

Inert gases



Inert gases reduce the oxygen in a risk environment to the point that fire cannot be sustained. In most cases it ensures oxygen in the room does not decrease to an unsafe level for humans. Using inert gas can avoid unwanted chemical reactions affecting the protected equipment or other valuable assets.

Inert gas systems have some advantages over ODS and SGG systems including more flexible pipework installation, longer hold times and better environmental profile. Storage containers and selector valves can protect several rooms with one bank of containers, which can be stored in a different location from the protected areas.

There are four common types of inert gases used in total flooding systems in Australia:

IG-01	100% argon
IG-55	50% nitrogen, 50% argon
IG-541	52% nitrogen, 40% argon, 8% carbon dioxide
IG-100	100% nitrogen

Typical applications

Inert gas systems are often used in the following applications:

- art galleries
- museums
- archive storage
- computer/operation rooms
- control rooms
- financial centres and banks
- electronics and data processing
- pharmaceutical/medical
- process industry control rooms
- rare book libraries
- record storage facilities
- substation control rooms
- switch rooms
- telecom centres
- universities and colleges
- marine.

Advantages & disadvantages of inert gas systems compared with ODS & SGG agents

Advantages

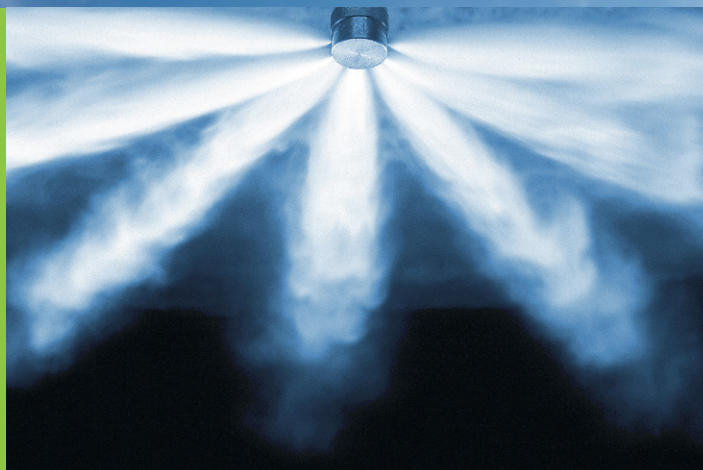
- Naturally occurring gases, environmentally acceptable.
- Argon and nitrogen pose no risk to the environment.
- Discharge does not result in fogging and ensures visibility is maintained for safe egress from occupied spaces.
- Clean agents, meaning there is no residue from system discharge.
- Do not produce thermal decomposition products, which can damage sensitive equipment.
- There is greater flexibility with pipework and length of pipe runs with inert agents.
- Discharges are spread over 60-120 seconds, depending on the standard used, so smaller diameter piping is required. (ODS and SGG systems are discharged in less than 10 seconds, and require large pipework).

Disadvantages

- Inert agent cylinders have a bigger footprint than an equivalent ODS and SGG system.
- Additional resources (cost/labour) would be required for replacing cylinders after discharge or during the 10-year maintenance period.
- Nozzle coverage areas are reduced compared with ODS and SGG systems.
- Greater need for pressure relief venting of the enclosures.
- Can require high-pressure pipework.

FK-5-1-12

(a common brand name is Novec™ 1230)



FK-5-1-12 fluid is a human-made chemical that is grouped in the synthetic agent category, but unlike the other synthetic agents FK-5-1-12 is not an HFC or HCFC; it is a fluoroketone. It is environmentally acceptable and a clean agent that can be used in occupied areas. FK-5-1-12 suppresses the fire by removing the heat from the fire and interrupting the combustion process. The fluid is clear and colourless and produces only a low odour. Stored as a fluid and then compressed with nitrogen, once discharged FK-5-1-12 atomises a short distance from the nozzle and floods the protected area.

Typical applications

FK-5-1-12 systems are often used in the following applications:

- telecommunication facilities
- computer operations
- control rooms
- shipboard (marine systems)
- rare book libraries
- universities & museums
- art galleries
- petrochemical installations
- pharmaceutical & medical facilities
- electronics equipment
- record & storage facilities.

Advantages & disadvantages of a FK5-1-12 gas system compared with ODS & SGG agents

Advantages

- Environmentally acceptable alternative.
- Low atmospheric lifetime of only five days.
- The bulk agent can be transported as non-dangerous goods.
- Less capital expenditure required for filling stations.

Disadvantages

- The agent is dense – this means that more agent is required and that the hold times are less.
- Systems can be more expensive than some ODS and SGG systems.
- Can have slightly increased space and weight requirements compared to an equivalent ODS and SGG system.
- Larger minimum clearance distances required around nozzles to ensure vapourisation of the agent.

CO₂ fixed fire suppression



The CO₂ suppression systems contain carbon dioxide in liquid form. When it is released into area being protected it decreases the percentage of oxygen available for combustion. CO₂ is a very effective clean agent and has been used in fire systems for almost 100 years. CO₂ has streaming properties, which makes it effective in local application systems (meaning the agent is directed on to a specific area rather than having to protect a whole volume) and total flooding systems.

Typical applications

CO₂ fixed fire suppression systems are often used in the following applications:

- electrical equipment in switchrooms
- electrical turbines
- local application systems protecting printing process, oil tanks or commercial deep fat fryers
- flammable gas vent stacks.
- record & storage facilities.

Advantages & disadvantages of a CO₂ fixed fire suppression system compared with ODS & SGG agents

Advantages

- Relatively easy to fill and agent is commonly accessible.
- Very good extinguishing and cooling properties making it one of the best choices for extended discharge systems or deep-seated fires.
- No thermal decomposition products.

Disadvantages

- Exposure to CO₂ at any design concentration used to extinguish a fire will cause death. It is a highly suffocating gas, concentration of even 9% in the breathing air would make a person unconscious within minutes, and extra safety equipment must be installed (lock-off valves) in any space where people are present.
- In fixed systems, the ice particles within the pipework can generate static electricity – so pipe grounding is important.
- Classified as dangerous goods.

Water sprinkler systems



Water is still one of the most useful and cost-effective ways to put out a fire. It can be used for Class A fires (combustible materials) such as wood, paper, plastics, and fabrics. There are different types of water-based sprinkler systems using a variety of sprinkler heads, valves, and pump sets. Typical water-based systems are not suitable for controlling Class B liquid fires, such as paraffin, petrol, oil-based fires, chip pan fires, or electrical fires.

The key difference between a water sprinkler system and a gaseous system is that the water sprinkler system controls the spread of fire to allow egress out of the building and protect the building from the fire growth. A gaseous system is designed to suppress and extinguish a fire. Most designs include equipment or asset protection within the risk area to minimise business interruption.

Advantages & disadvantages of a water sprinkler system compared with ODS & SGG agents

Advantages

- Environmentally acceptable.
- Cooling effect – excellent surface wetting and cooling properties to rapidly reduce the flames.

Disadvantages

- Limited use in specialist applications.
- Controls the spread of fire – not designed to extinguish.
- Not designed to protect equipment or business continuity.

Water mist systems



A water mist system is a fire protection system, which discharges very fine water droplets. The water mist controls, suppresses or extinguishes fires by:

- cooling the flame and surrounding gases by evaporation
- displacing oxygen by evaporation
- attenuating radiant heat by the small water droplets.

Typical applications

Water mist fire suppression systems are often used in the following applications:

- museums
- military Installations
- pharmaceutical/medical
- process Industry
- telecom centers
- universities and colleges
- vehicles
- chemical stores
- hotels
- apartments
- heritage listed buildings
- oil and gas Industry
- power generation
- shipboard and marine.

Advantages & disadvantages of a water mist system compared with ODS & SGG agents

Advantages

- Environmentally friendly.
- No toxic by-products from decomposition.
- Easy to refill.
- Highly efficient fire suppression capability.
- Very effective at extinguishing large flammable liquid fires.
- More tolerant of openings in an enclosure.
- Longer discharge and protection times.
- Ideal for larger fires where ongoing cooling is required.
- Can be used in a local application.
- Can also scrub the surrounding air, removing airborne particulates.

Disadvantages

- Initial capital expenditure can be higher.
- They do not perform as well in open-plan areas or large areas generally where 'drift' has proved to be a major disadvantage.
- Can have increased space and weight requirements compared to an equivalent ODS and SGG system.
- More nozzles are required for a given floor area increasing the amount of pipe in a pipe network compared with ODS and SGG systems.
- Full-scale fire testing is required for each application.

Hybrid (water mist/inert gas)



Hybrid water mist systems are a combination of clean agent inert gas and water. The mist is produced in a manner that maximises the best attributes of each, by having nitrogen injected into the water stream at the nozzle. This produces extremely small droplets and acts to reduce the oxygen concentration in the protected risk.

Typical applications

Hybrid fire suppression systems are often used in the following applications:

- control rooms/switch rooms
- generator sets
- turbines
- hoist houses (hoist/winch)
- collar houses (shaves)
- draglines
- bucket excavators
- fuel bays
- machine shops
- lube bays
- welding bays
- electrical rooms
- critical pumps
- underground mines.

Advantages & disadvantages of a hybrid (water mist/inert gas) system compared with ODS & SGG agents

Advantages

- Environmentally acceptable.
- Non-toxic.
- Simple modular design makes installation and service easier.
- No need for annual enclosure integrity testing.
- Low water consumption.

Disadvantages

- They are not clean agents.
- Can have increased space and weight requirements compared to an equivalent ODS and SGG system.
- They are a relatively new system, and currently, there are no Australian standards. Systems are dependent on manufacturers manuals rather than industry consultation on design and installation requirements.

Condensed aerosol



Condensed aerosol fire extinguishing agents consist of very fine (micron-sized), usually potassium based, particles suspended in a gas. The particles interfere with and stop the fire chain reaction. Weight for weight, condensed aerosols are more efficient at extinguishing flammable liquid fires than halon. While very efficient fire extinguishing agents, condensed aerosols are not classed as clean agents as they leave a residue after discharge.

Typical applications

Condensed aerosol fire suppression systems are often used in the following applications:

- flammable liquid storage
- turbine enclosures
- electrical cabinets
- vehicle engine compartments
- switchgear
- marine engine rooms.

Advantages & disadvantages of a condensed aerosol system compared with ODS & SGG agents

Advantages

- Environmentally acceptable.
- Simple modular design makes installation and service easier.
- Non-conductive.
- No installation of pipe and nozzles – with considerable savings in installation.
- Considerable space savings over cylinders.
- Minimal maintenance – no pressure testing.
- Less expensive.
- Simple design calculations.
- No handling of compressed gas cylinders.

Disadvantages

- They are not clean agents.
- Some are non-toxic and approved for use in occupied areas. However, some are toxic and not approved for occupied areas and needs to be checked with the manufacturer.
- Classified as dangerous goods.
- Not suitable for deep-seated fires.

Oxygen reduction fire prevention (ORFP) systems



Oxygen-reduction fire prevention systems create an environment of breathable, controlled oxygen-reduced air that prevents fire ignition. Oxygen-reduction systems are designed to prevent fires rather than suppressing fires. Oxygen-reduction fire prevention systems use a technology that produces oxygen-reduced (hypoxic) air by partly filtering out oxygen from the ambient atmospheric air. Normal atmospheric air contains 21 per cent oxygen, and the system controls the air in the protected space to typically below 15 per cent oxygen. Common flammable solid materials and liquids cannot be ignited with an oxygen level below 15 per cent.

Typical applications

Oxygen reduction fire prevention systems are often used in the following applications:

- cultural artifacts
- heritage archive stores
- data centers
- server rooms
- electrical switch rooms
- hospitals.

Advantages & disadvantages of an ORFP system compared with ODS & SGG agents

Advantages

- Environmentally acceptable.
- Non-toxic.
- Simple low-pressure pipework.
- Prevents a fire from starting.
- No refill costs.
- Simple installation process.
- Slows oxidation and reduces deterioration of materials, equipment, documents, and artifacts.

Disadvantages

- Enclosures need to be well sealed.
- Ongoing running costs to consider.
- Need to ensure safety requirements around entry to space – complete a risk assessment for personnel.
- Need to ensure safe venting of oxygen-rich air.
- They are a relatively new system, and currently, there are no Australian standards. Systems are dependent on manufacturer's manuals rather than industry consultation on design and installation requirements.
- Needs to be coupled with detection, it prevents fire/flare from starting; it does not prevent the cause of the fire.

Appendix

Aspects to consider when changing to an alternative:

Hazard	<ul style="list-style-type: none"> • What is the new hazard? • What alternatives are approved for the hazard? • Different alternatives operate on different extinguishing mechanisms. • Is it an occupied space? • The amount of agent is different for each alternative and is hazard dependent. • Time of discharge/speed of suppression. • Is it a clean agent? • Ease of servicing.
Container location	<ul style="list-style-type: none"> • Distance from the hazard, effect on hydraulics of the system. • Space for cylinders, some alternatives have a much more significant footprint. • Manual handling for alternatives is different. • Access for installation, servicing, decommissioning. • Floor loading: <ul style="list-style-type: none"> ◦ example – 500m³ FM200 system – floor loading approx. 570kg ◦ example – 500m³ IG-55 system – floor loading approx. 2000kg • May not have cylinders (water mist pump or ORFP) – but may need water available/tanks or other equipment.
Pipe Network	<ul style="list-style-type: none"> • Pipework design/layout – usually different. • Layout might have more restrictions. • Different pipe size/no pipe at all. • Different pipe ratings/fittings class. • Penetrations through walls. • Bracketing changes – support more/heavier pipe.
Control and Alarm	<ul style="list-style-type: none"> • Is the detection method in combination with an alternative still appropriate for a hazard? • Changes to actuation and monitoring. • Any additional valves, switches, controls. • Is there a change required to batteries? • Do the control and alarm meet the current standards? • Does equipment need to maintain an IP or IEC rating?
Maintenance	<ul style="list-style-type: none"> • New maintenance requirements – different systems have different requirements. • Manufacturer's recommendation on new equipment. • Changes in baseline data. • Whole of life costs. • Ongoing running costs.
Decommissioning	<ul style="list-style-type: none"> • Licensed person/company. • Pre-determine transport methodology. • Safe procedures when removing cylinder(s). • Cylinders containing ODS and SGG are sent to licensed company for reclaim/recycling/destruction. • Other items can be recycled or correctly disposed of, i.e. steel pipe, brackets, nozzles, signage, etc.